

EECS3101 (Section Z) Winter 2026
Tutorial 5
Proving or Disproving Properties of Trees and Graphs
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No Submission Required: Complete for Learning & Test Prep

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1 A Property of Binary Trees

Given a binary tree, say T , that is both *nonempty* and *proper* (i.e., each *internal* node has two child nodes), prove or disprove the following claim:

Sum of the number of internal nodes (n_I) and the number of external nodes (n_E) in T is an odd number.

Requirement. If you decide to prove it, you **must** do so via a mathematical induction. If you decide to disprove it, you must suggest a witness.

2 Properties of Graphs

Given an *undirected* graph $G = (V, E)$ with $|V| = n$, $|E| = m$, prove or disprove the following claims:

$$\begin{cases} m = n - 1 & \text{if } G \text{ is a **spanning tree**} \\ m \leq n - 1 & \text{if } G \text{ is a **forest**} \\ m \geq n - 1 & \text{if } G \text{ is **connected**} \\ m \geq n & \text{if } G \text{ contains a **cycle**} \end{cases}$$

Requirement. For each claim, if you decide to prove it, you **must** do so via a mathematical induction. If you decide to disprove it, you must suggest a witness.